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THE BAYESIAN VOTER: THE DYNAMICS OF INFORMATION AND LEARNING IN A PRESIDENTIAL ELECTION CAMPAIGN

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You can fool some of the people all of the time, and all of the people some of the time, but you cannot fool all of the people all of the time.

Abraham Lincoln
Clinton, Illinois, September 2, 1858

We have undertaken to teach the voters, as free, independent citizens, intelligent enough to see their rights, interested enough to insist on being treated justly, and patriotic enough to desire their country's welfare. Thus this campaign is one of information and organization. Every citizen should be regarded as a thoughtful, responsible voter, and he should be furnished the means of examining the issues involved in the pending canvass for himself.

Grover Cleveland
Letter to Chauncey E. Black, September 14, 1888

THE BAYESIAN VOTER: THE DYNAMICS OF INFORMATION AND LEARNING IN A PRESIDENTIAL ELECTION CAMPAIGN *

R. Michael Alvarez

1 Introduction

Political scientists have long been pessimistic about the effects of presidential campaigns on voter decision making. The pioneering work of the "Columbia School" in the companion volumes *The People's Choice* by Lazarsfeld, Berelson and Gaudet (1944) and *Voting* by Berelson, Lazarsfeld and McPhee (1954) set the agenda both methodologically and substantively for what is now called the "minimal effects" hypothesis. They were concerned with measuring the effect of the campaign on the electorate, and to do this, they were the first to use the panel survey to study presidential elections. The first study (discussed in in *The People's Choice*) was conducted in Erie County, Ohio, between May and November, 1940. Of an original sample of 3000, interviewed in May, they took four samples of 600 individuals. One of these samples was re-interviewed each month until the election; the other three were each re-interviewed once. Concurrently, another group of researchers gathered monthly samplings of the events in the campaign, the candidate's statements, and the coverage in the media of the campaign.[1] The idea was to measure the changes in preferences which the Columbia researchers expected to occur during the electoral season and then match those changes in preferences with campaign events and information (Natchez 1985).

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[1]The 1948 study which culminated in the publication of *Voting* was of a similarily innovative design. The study focused on one community, Elmira, New York, and the panel consisted of interviews of respondents in June, August, October, and November. Also data on the campaign was collected as well.

But instead of documenting dramatic changes, the Columbia team found an amazing stability of preferences in the 1940 election: "What the political campaign did, so to speak, was not to form new opinions but to raise old opinions over the thresholds of awareness and decision. Political campaigns are important primarily because they *activate* latent predispositions" (Lazarsfeld, Berelson and Gaudet 1944: 74). In terms of voting decisions, they found that the presidential campaign changed few minds, and for most voters, the campaign only reinforced their predispositions to vote for one candidate or the other. Thus they reached what should have been a startling conclusion: "In sum, then, this is what the campaign does: reinforcement (potential) 53%; activation 14%; reconversion 3%; partial conversion 6%; conversion 8%; no effect 16%" (Lazarsfeld, Berelson and Gaudet 1944: 103). This is a remarkable finding, since only 14% of their sample *changed their voting decision* during the course of a presidential election campaign. Thus began the "minimal effects" hypothesis — that campaigns and the mass media only influence mass preferences at the margin (Iyengar and Kinder 1987).

The second important substantive finding to come out of the Erie County study involved the informational content of the campaign. From a dataset covering a number of major radio addresses by the candidates, radio newscasts, magazine editorials and articles, and front-page newspaper coverage, the Columbia team also set out to discover what information had been passed to the electorate during this campaign.[2] They found that an overwhelming proportion of campaign information concerned the campaign itself, campaign tactics, and the relative standings of the candidates in the race (over one third); with lesser coverage of Roosevelt's record (one quarter); and the remainder devoted to discussions of the candidate's personal characteristics and policy proposals.

These conclusions were buttressed by their analysis of the major radio addresses of the candidates in 1948. Again, they asserted that campaign information was not policy-oriented — Truman's speeches covered general aspects of the campaign (35%), while Dewey concentrated on the symbolic issue of the 1948 race, the "unity of the American people" (26%). Additionally, in the 1948 data they found that "The opposing candidates tended to 'talk past each other,' almost as though they were participating in two different elections" (Berelson, Lazarsfeld and McPhee 1954: 236). Therefore, the major conclusions that came out of their early analysis of the informational content of the campaign was that little "substance" was discussed during the campaign and that the candidates did little to force direct confrontation on issues in their campaign rhetoric. Yet the Columbia team did not relate directly either of these two findings to their conclusion that campaigns do not induce voters to alter their preferences.[3]

[2]It is not clear from the discussion in *The People's Choice* exactly what the criteria for inclusion of a news source, and consequently a particular campaign story, into this analysis was. Nor is the coding or classification scheme given. They are also vague about their campaign data in *Voting*.

[3]This is odd, since in the 1948 election they relate the shift toward Truman late in the campaign to the fact that the standards by which many voters evaluated Truman changed from his personal characteristics to his stands on labor and class issues (Berelson, Lazarsfeld and McPhee 1954: 269). What makes it so odd is that their own data in the previous chapter shows that Truman stressed labor issues relatively heavily in his speeches (p. 236).

The last important finding in this work was articulated most clearly in *Voting*. Here they found that voters selectively obtained information. First, some voters were systematically more exposed to political information, especially the mass media, than others. Second, voters were more likely to pay attention to information which was favorable to their preferred candidate. And lastly, they showed that voters tended to see their preferred candidate's stands on issues as similar to their own, and the opponent's as much different than theirs.

But even though selective exposure seemed pervasive, a number of interesting campaign effects can be observed in their data. Truman's policy positions, which were clearer and more confrontational than Dewey's, were much less subject to projection and misperception. Also, as the campaign progressed, perceptual accuracy about the issue positions of the candidates among voters increased. And last, those who were more exposed to campaign information were more accurate in their perceptions of the candidate's stands as well. Thus, even though the campaign may not have changed the preferences of most voters, it influenced the information obtained by the voters and their propensity to misperceive the positions of the candidates on policy issues.

The importance of the Columbia research cannot be underemphasized. First, this research was methodologically innovative, especially regarding the development of the panel study. Second, it established the subsequent research agenda with their conclusion that political campaigns had only marginal conversion (or persuasion) effects. Third, and typically understated in this literature, they found substantial evidence that political campaigns lead to significant changes in how voters perceive or misperceive candidates.

Interestingly, it has been the second finding of the Columbia research which has received the greatest publicity in the political science literature. Writing specifically about the effects of the news media on the political perceptions of citizens, Patterson and McClure argued that "most network newscasts are neither very educational nor very powerful communications" (1976: 90). Their detailed analysis went even further than the Columbia results, and led Patterson and McClure to conclude that television news had almost no political ramifications at all. And in a follow-up study, patterned closely on the Columbia analyses (panel surveys during the 1976 campaign combined with extensive content analysis of the campaign coverage in the media), Patterson reached virtually the same conclusion:

> Election news carries scenes of action, not observations on the values represented by these scenes. Election news emphasizes what is different about events of the previous 24 hours rather than everyday political topics. Election news concentrates on competition and controversy instead of basic policy and leadership questions . . . the news is not an adequate guide to political choice. The candidates' agendas are not readily evident in press coverage of the campaign (1980: 174).

In most of the major studies which have followed up on the conclusions of the Columbia school, finding evidence that campaigns and mass media sources have little *persuasion* effects has not been very difficult.[4]

This is not to say that campaigns and the mass media have no political effects. Rather, it might simply be that looking for campaign or media persuasion is incorrect; instead of looking for changing voter preferences, campaigns and the mass media might have a broader (and more important) impact. Perhaps the Columbia school was correct — the information the campaign provides shapes mainly voter perceptions, and not their preferences. Interestingly, there are some recent studies, from quite diverse methodological perspectives, which demonstrate this very point.

One puzzling aspect of the "minimal effects" literature is that it is difficult to imagine that the mass media could have no political effects, given the exceptional amount of information which is present in the media in an election year. Graber (1988) conducted an intensive study of twenty-one voters during the 1976 election season, combined with a content analysis of the media outlets they were exposed to in Evansville, Illinois. In her breakdown of only politically-relevant media coverage in the 1976 election, Graber found a total of 30,662 news topics covered in the local newspapers, and 38,510 news topics covered by the local and national television newscasts. The question in the face of these figures is how individuals cope with such a tsunami of political information.

Graber, working within a cognitive information processing framework, finds that the individuals in her analysis have very efficient methods of dealing with the flood of information. In the first stage, people simply ignore old and redundant information. Then, Graber argues, the stories they deem interesting or novel are processed schematically, allowing the individual to integrete the information into their existing knowledge structures. And since news is often repetitive, substantial learning does occur. Therefore, even with the seemingly haphazard approach taken by the individuals in her study, there is such a massive amount of information available during a presidential election, that "Americans are capable of extracting enough meaningful political information from the flood of news to which they are exposed to perform the modest number of citizenship functions that American society expects of them" (Graber 1988: 252).

Additionally, Iyengar and Kinder (1987), combining survey data with a large number of experimental studies, offer convincing evidence against the "minimal effects" hypotheses. First, their analysis of the 1980 election shows that the media was capable during that election of inducing substantial changes in individual preferences. However, a number of special circumstances need to be present for substantial persuasion to occur during a political campaign – many voters must remain uncommitted until the last days of the race, late political events must be covered extensively by the media and be politically relevant, and these political events must favor one candidate.

[4]See Finkel (1993) for both an example of such research and an excellent review.

Instead of persuasion, though, Iyengar and Kinder find substantial support for the notion that the television media has a great deal of political influence. And here their work ties directly into the findings by the Columbia school, in that the major effects of the campaign and television news "appears to rest not on persuasion but on commanding the public's attention (agenda-setting) and defining criteria underlying the public's judgments (priming)" (Iyengar and Kinder 1987: 116).

Yet more recently, there have been many important works supporting the notion that political campaigns and the mass media have a significant influence on the mass electorate — both on their preferences and the criteria underlying those preferences. In the 1976 presidential election, Conover and Feldman (1989) observed that misperceptions of the candidate's stands virtually disappeared as the general election campaign progressed. Working with data on presidential primaries, Bartels (1988) and Popkin (1991) have both shown that campaign events and changes in available information about candidates lead to substantial changes in the criteria voters use to judge candidates, and hence, to changes in their relative evaluations of primary candidates. With senate elections data, Franklin (1991) has shown that the information made available by the candidates competing for office influences voter perceptions. Zaller, working across these national elections, summarized his results (and the literature): "Campaigns bring about attitude change, as I have sought to show, not by producing a sudden conversion experience, but by producing incremental changes in the balance of considerations that underlie people's summary attitudes" (1989: 231).

Two immediate conclusions should be taken from this literature. Clearly, campaigns and the mass media "matter." That is the most important point raised by the flurry of recent research on this topic. In fact, it strains the imagination to think that campaigns and the mass media do not have important electoral ramifications. So many important events happen in a campaign, and there is such a flood of campaign and political media coverage during the electoral season, that both must have some effect. If not, then why would candidates bother to campaign, and why would the media bother to cover the race?

More importantly, this literature argues that the effects of campaigns and the mass media should not be expressed directly in changes in electoral preferences — in Iyengar and Kinder's terms, in persuasion. Clearly it is difficult to change the minds of voters, and neither political campaigns nor the mass media are well suited for that task. However, perceptions are less malleable, and are more subject to change. Perhaps even more subject to change are misperceptions, or the degree to which the perceptions of voters are inaccurate. Most of these works, from the Columbia research to the most recent work summarized above, argue that political campaigns and the mass media can and do influence voter perception and misperception, and therefore, indirectly influence preferences as So to study the impact of the political campaign and the media on the electorate, a better focus might be on the perceptions and misperceptions of voters.[5]

In the remainder of this paper, I offer a theoretical model which provides this focus. My approach is rooted in a simple Bayesian model of learning, which produces a flexible and

[5]A similar argument is advanced in Alvarez and Franklin (1993).

useful model of voter learning during a campaign. Then I test some simple implications of the model using data from the 1976 presidential election. These tests show first that there were substantial changes during the 1976 campaign in the information made available about the candidates: as the election neared, more "substantive" information was presented to voters. Second, I show that with more information about the policy positions of the candidates, voters perceived those positions with greater certainty. Additionally, this learning took place mainly among those voters with the most to learn — those with the least information, education, and media exposure. I conclude with a discussion of the utility of this approach for understanding voter decision making in presidential elections.

2 A Bayesian Model of Campaign Learning

2.1 The Basics of the Bayesian Model

To examine the dynamic relationship between campaign information and voter perception and preference, I employ a simple Bayesian model of political information. The Bayesian learning model, like the spatial model of voting, is not a completely descriptive model of behavior. Instead, it provides an explicit, consistent, and systematic accounting of the way in which individuals might combine newly encountered information with their past understandings of the political world.[6] While Bayesian models are rare in the political science literature, their empirical applications have been successful (Achen 1992; Bartels 1993; Calvert and MacKuen 1985; Franklin 1992; Husted, Keyyy and Morton 1993; Zechman 1978).

The intuition behind the Bayesian model is compelling. Basically, the model states that the voter has prior perceptions or information (called "priors"), and that these prior beliefs are updated with the acquisition of new information, yielding revised, "posterior" beliefs. The Bayesian approach provides a particular mathematical framework for the formation of new perceptions. To express the Bayesian model formally, first define θ_{kt} to be candidate k's position on a particular issue at time t, γ_{kt} to be the voter's knowledge of the candidate's position, and η_{kt} to represent information received about the candidate k's position.

Next, instead assuming that voters *should be perfectly informed* during a presidential election season, I assume that they *are imperfectly informed* about candidates and their policy

[6] Many believe the Bayesian model to be of little utility in the analysis of perceptual formation and change. But the Bayesian model actually complements the psychological learning models which have become popular in the political science literature. Where the cognitive psychological models have presented very complete descriptions of the structures of past political information, whether they are termed scripts, schemas, stereotypes, or whatever else, these models have been less descriptive as to the processes by which new information is incorporated into these cognitive structures (some attempts have been made in this literature to overcome this tendency; see Conover and Feldman 1989; Lodge and Hamill 1986; Lodge, McGraw and Stroh 1989). While the Bayesian model is less descriptive in the structuring of past information, it is more rigorous in the description of how newly-encountered information can be combined with old knowledge for updated assessments of the political world. See Achen (1992) for additional discussion.

stands. It has long been an established truism that voters are poorly informed (e.g., Campbell et al. 1960), with the debate centering over the causes of their imperfect information (Key 1966). Some of the imperfections in the information flow stem from the candidates and the information transmission process, others from the abilities and incentives of voters (Page 1978: 281).

Here, I assume that the beliefs (or perceptions of the candidate on issues, in this case) are known imperfectly by the voter, and hence, are described as a set of probability distributions. The voter's prior probability distribution, the voter's calculation of the probability that the candidate will have a certain position once in office, conditioned on their knowledge of that position, is defined by:

$$P(\theta_{kt} \mid \gamma_{kt}) \sim N(\mu_1, \sigma_1^2) \tag{1}$$

This states that the voter's calculation of the candidate's position developed from past knowledge of that position is assumed to be normally distributed with a mean μ_1 and a variance σ_1^2. Similarily, the probability that the voter would actually observe the newly encountered information, η_{kt}, conditioned on the candidate's position and the voter's knowledge of that position, were the candidate in office is defined as:

$$P(\eta_{kt} \mid \gamma_{kt}, \theta_{kt}) \sim N(\mu_2, \sigma_2^2) \tag{2}$$

And last, the voter's posterior distribution also has a similar definition, where the probability that the candidate is actually at the particular position is conditioned on the voter's knowledge of the position and the newly-encountered information about the candidate:[7]

$$P(\theta_{kt} \mid \gamma_{kt}, \eta_{kt}) \sim N(\mu_3, \sigma_3^2) \tag{3}$$

Now that these probability distributions have been defined, Bayes' Theorem states that the posterior distribution is proportional to the product of the prior distribution and the distribution of the newly-encountered information. That is,

$$P(\theta_{kt} \mid \gamma_{kt}, \eta_{kt}) \propto P(\theta_{kt} \mid \gamma_{kt}) * P(\eta_{kt} \mid \gamma_{kt}, \theta_{kt}) \tag{4}$$

This can be expressed in terms of the moments of these distributions as:[8]

$$\begin{aligned} \mu_3 &= \frac{\tau_1 \mu_1 + \tau_2 \mu_2}{\tau_1 + \tau_2} \\ \tau_3 &= \tau_1 + \tau_2 \end{aligned} \tag{5}$$

Note that $\tau_j = (\sigma_j^2)^{-1}$ for j=1,2,3. While the τ_j are termed "precisions" in the literature, they really are just the inverses of the voter's uncertainty regarding each bit of information

[7]Here I have assumed the normal distribution for simplicity. Other distributions can be used in this model (DeGroot 1970). Also, I have assumed that the information the voter receives is costless. Future development of this learning model, incorporating costly information, is clearly necessary.

[8]Derivations of this step are in Zechman 1978, Appendix A, as well as in Judge et al. 1988, Chapter 4, and in most references on decision theory (Berger 1985; DeGroot 1970; Jones 1977).

— their previous understanding of the candidate's position, the new information received, and their new understanding of the candidate's position.

So what is the interpretation of this Bayesian learning model? Where the voter perceives the candidate to stand on the issue, in light of some new information, is the weighted average of their past knowledge of the candidate's position and their newly-obtained information. The weights, further, are simply the precisions of each piece of information, which have been defined as being proportional to the variances of the relevant probability distributions. The voter finds out something new about the candidate's position — from speeches, conventions, advertising, advertisement, the media, or whatever source — and alters their perception of this position in the direction of the new information. But, and of importance for this discussion, *the amount by which voters alter their perceptions depends on the precision of the new information, relative to their past perceptions.*

In order to highlight the intuition behind the Bayesian model as presented in Equation 5, the effects of newly-obtained information upon both the mean and precision of the voter's posterior distribution regarding the position of the candidate on an issue are shown graphically. I performed two sets of simulations by setting all of the terms in Equation 5 to the following simulated values. The voter's prior knowledge of the candidate's position (μ_1) is 0.5. The voter then receives new information that the candidate's expected position is 1.5. To assess the effects of the precision of these both the prior and new information on the voter's posterior knowledge, I then varied the precision of the new information about the candidate's position (τ_2), which takes a range of hypothetical values from zero (extreme imprecision) to 20 (extreme precision), and the precision of the voter's prior knowledge of the candidate's position (τ_1), which I varied across three values, low, moderate, and high. These simulations are given in Figure 1, where the top panel gives the mean of the voter's posterior knowledge and the bottom panel gives the posterior precision. In each panel, the lines represent one of the assumed levels of prior precision while the x-axis gives the precision of the new information.

What is interesting to notice in the top panel of Figure 1 is the effect which the two precisions have on the voter's adjustment of their perception. When the precision of their prior knowledge is low, even relatively imprecise new information can induce a dramatic change in the posterior mean in favor of the new information. However, as the precision of the prior knowledge increases, the voter places more weight on their prior knowledge than on the new information, so the new information must be extremely precise to induce a change in the perception of where the candidate stands on the particular issue.

In the bottom panel of Figure 1 the y-axis represents the precision of the posterior distribution. Recall that the posterior precision is simply the sum of the precision of the prior knowledge and the new information, which accounts for the linear relationships seen Figure. Not surprisingly, a positive relationship is observed in the Figure for each level of prior precision, indicating that as the precision of the new information increases, so does the precision of the posterior. Also worth notice here is that new information in the model always increases posterior precision. Thus, the model predicts that if the voter has a very

precise prior understanding of where the candidate stands on the issue, and encounters very precise information which leads them to update their prior perceptions, the precision of their posterior knowledge will be greater, though not by a very large amount.[9]

So far, I demonstrated two aspects of the Bayesian model: the effects which newly-obtained information has on each element of the voter's knowledge of the candidate's policy stands — the mean and precision (or variance) of that distribution. The next step is to show how changes in voter perception of candidate issue positions are incorporated into their evaluations of the candidates. For this purpose, I use the spatial model of voting.[10]

In this version of the spatial model, I assume there are two candidates and that the preferences and utility functions of voters are such that the axioms of expected utility maximation apply. Also, I assume that there is one policy dimension relevant to the voter, and that the voter takes only information about their position and the candidate's position on this issue into account. The voter's expected utility from a particular candidate J is the utility the voter would anticipate, conditioned on their posterior distribution, is (Zechman 1978):

$$E(U(\theta_J) \mid P(\theta_J \mid \gamma_J, \eta_J)) \tag{6}$$

This leads to a decision making rule for the voter, that is, vote for candidate J instead of G iff:

$$E(U(\theta_J) \mid P(\theta_J \mid \gamma_J, \eta_J)) \geq E(U(\theta_G) \mid P(\theta_G \mid \gamma_G, \eta_G)) \tag{7}$$

Assume, as above, that the voter's posterior is distributed normally, with a mean and a variance (proportional to the precision), and as in the earlier sections of this chapter, that the distance between the voter and the candidate can be written in terms of quadratic loss. This implies that the voter will prefer candidate J iff $(\mu_{3J} - \omega_3)^2 \geq (\mu_{3G} - \omega_3)^2$, that is, if the posterior mean of candidate J is closer to their position (where the voter's position is denoted by ω) than the posterior mean of candidate G. By substituting from Equation 5 for each candidate, this gives an amended decision rule, vote for candidate J iff:

$$\left(\frac{\tau_{1J}\mu_{1J} + \tau_{2J}\mu_{2J}}{\tau_{1J} + \tau_{2J}} - \omega_3^2\right) \geq \left(\frac{\tau_{1G}\mu_{1G} + \tau_{2G}\mu_{2G}}{\tau_{1G} + \tau_{2G}} - \omega_3^2\right) \tag{8}$$

As complex as this might seem, interesting insights into the dynamics of voter preferences are obtained by analysis of the relationships between information, perceptions, and preferences in Equation 8. A very easy way to gain intuition into these relationships is again through simulations. The model in Equations 7 and 8 can be written probabilistically, and in that formulation, the relationship between the various elements of Equation 8 and the probability that a typical voter might support one of the candidates can be easily shown.

[9]Since the variances of these distributions are assumed to be positive, so are the precisions. Under such conditions, the precision of the posterior will never be less than the precision of the prior.

[10]The incorporation of the updated knowledge of the candidate's position into the spatial model is relatively simple to demonstrate. More exhaustive discussions are in Calvert (1980) and Zechman (1978). Discussion of the standard spatial model of the sort I employ here is found in Enelow and Hinich (1984).

First, to cast this model into a probabilistic format, I assume that the expected utility for candidate G is zero. Second, I assume that the non-issue components (denoted here by c_{iJ} of the voter's evaluation of candidate J are distributed normally, and are independent of the voter's issue-based evaluation of the candidate.[11] These assumptions allow me to examine the Bayesian model probabilistically. First, rearrange the terms:

$$\left(\frac{\tau_{1J}\mu_{1J} + \tau_{2J}\mu_{2J}}{\tau_{1J} + \tau_{2J}} - \omega_3^2\right) \geq 0 \tag{9}$$

$$I_{iJ} + c_{iJ} \geq 0, \tag{10}$$

where $I_{iJ} = \left(\frac{\tau_{1J}\mu_{1J}+\tau_{2J}\mu_{2J}}{\tau_{1J}+\tau_{2J}} - \omega_3^2\right)$. Then, under the assumption that c_{iJ} is distributed normally and independently of I_{iJ}, this expression can be written probabilistically:

$$P[I_{iJ} + c_{iJ} \geq 0] = \int_{\infty}^{I} \frac{1}{\sqrt{2\pi}} \exp^{\frac{-c^2}{2}} du \tag{11}$$

This presentation allows me to insert hypothetical values into this probabilistic model and to depict graphically the relationship between the uncertainty the voter has about the candidate's policy positions and the probability that the voter would support the candidate. Four such simulations were carried out, with two in the top panel of Figure 2 and two in the bottom panel.

The x-axis in each panel of Figure 2 gives the precision of the newly-encountered information, and the y-axis gives the *change* in probabilities of supporting the candidate once the new information has been assimilated by the voter. The new information the voter receives is that the candidate is closer to the voter on the issue than reflected in their prior knowledge. Two lines are plotted in each panel, one for a situation where the new information indicates that the candidate is much closer to the voter's position on the policy issue than the voter previously believed (dotted line), and one where the information states that the candidate is not much closer to the voter on the issue (dark line). The top panel presents these plots for a situation in which the voter's prior knowledge was *imprecise*, while the bottom panel gives the plots for a scenario in which the voter's prior knowledge was *precise*.

Comparision of the results of these simulations produces some interesting conclusions. First, in the top panel of Figure 2 it is apparent that when the voter has an imprecise prior knowledge of the candidate's position, and receives new information that the candidate is closer to their ideal point, that relatively large changes in the voter's probability of supporting the candidate occur across a wide range of precisions of the new information. Compare two scenarios. First, the new information is very imprecise, with a precision near zero, and second, where the information is relatively precise, at a simulated value of approximately nine. In the first scenario, the probability that the voter supports the candidate does not change very much, no matter how close the candidate has moved to the voter's position,

[11] Note that these assumptions are only required to demonstrate this theoretical model probabilistically, and are not relevant in subsequent empirical evaluation of the model.

since their perception of the candidate's position is simply not very precise. However, in the second scenario, notice the wide divergence between the changes in probability of supporting the candidate where the candidate has moved much closer to the voter, relative to only slightly closer. As we might anticipate, when the prior information is imprecise, but the new information is precise, the voter adjusts their evaluation of the candidate weighing heavily the new information, evidenced by the large change in the probability of supporting the candidate, and these changes are greater when the information indicates that the candidate is closer to the voter on the issue.

But in the bottom panel of Figure 2, where the prior information is much more precise, a different conclusion is apparent. Again, compare two scenarios, the first in which the voter's new knowledge is very imprecise (near zero), as compared to a situation in which the information obtained is relatively precise (near nine). Interestingly, in the first scenario, the voter is very unlikely to support the candidate — since their relatively precise prior states that they are not very near to the candidate on the issue, and very imprecise information does little to change this prior. Yet in the second scenario, there is a change in the likelihood that the voter would support the candidate (the difference in simulated probabilities is approximately 0.35 for the voter close to the candidate and around 0.05 for the voter further from the candidate), indicating that precise information can lead to a change in preferences when the new information is itself precise.

What is most interesting here, however, is the comparison between the Figures. The conclusions when the new information obtained by the voter is very imprecise do not vary whether the candidate is near or far from the voter, or whether the priors are precise or imprecise. But when the new information is precise, we do see a good deal of variation depending on the relative location of the candidate *and* the precision of the prior knowledge. In the two simulations where the voter is closer to the candidate, they are more likely to support the candidate when they obtain new and precise information about the candidate's position.

But when the prior information is less precise, and the information reveals that the candidate is much closer to the voter, the change in probabilities is drastically greater than when the prior information is more precise. New information — even relatively imprecise information — leads the voter to update their knowledge greatly and to even change their evaluation of the candidate, when prior information about the candidate's position is uncertain. However, when the voter's prior knowledge is more certain, new information — even relatively precise information — does not lead to a great deal of updated perceptions and does not result in relatively large changes in candidate evaluations.

2.2 Insights from the Bayesian Model

The Bayesian model discussed in the previous section revealed some very interesting implications for the way in which new information about a candidate's policy position might

influence a voter's perception or misperception of the candidate's position, and their evaluation of the candidate. Two general hypotheses follow from the discussion in the last section. First, *voters should update their perceptions of candidate issue stands when they obtain new information about those stands; thus the perceptions of voters should change when information about these stands becomes increasingly available during the campaign.* Second, *new information will lead voters to change their evaluations of the candidate, especially when the prior information was very imprecise.*

Thus by incorporating *imperfect information* into an individual-level model of voter preferences and perceptions, the Bayesian approach sheds insights into many of the past findings in the literature. I have shown that when presented with new information about the positions of the candidates on policy issues, voters should assimilate that information into their perceptions of the candidates' stands. This "learning" should occur on two levels: voters are expected to update, or change, their estimate of the candidate's position (the mean), as well as their uncertainty of the candidate's position (the precision). Therefore, when information is available, perceptual learning should occur in the electorate. Demonstrating this relationship, then, will show that campaigns do "matter."

Yet the Bayesian learning model also implies that the effects of campaign learning should be most apparent in the perceptions or misperceptions of voters. Usually, in general elections at the presidential level, voters will have some, if not a great deal of prior knowledge of both candidates. In such a situation, the insights of the Bayesian model are that we expect to see new information have little effect on the expected value of the voter's perceptions, but perhaps a larger effect on the certainty of their perception; additionally we would rarely expect a substantial change in their preferences. In this perspective, the "minimal effects" findings are really not so surprising — in presidential election, with incumbents fighting against well-known challengers, or even with nationally-prominent challengers contesting for an "open" seat, voters should have relatively precise priors even at the beginning of the general election season.

But different electoral contexts might produce different conclusions. For example, early in a presidential primary, when voter knowledge of the positions of the candidates is very uncertain, new information, even if it is also uncertain, can produce large changes in the voter's perceptions of the candidate's position, their uncertainty of that position, *and even in their preferences.* This provides a theoretical account for the volatility witnessed early in the primary season in voter preferences and perceptions. They have imprecise knowledge, and learning new information in an uncertain situation can have dramatic consequences.

So generally, we would expect information to have different effects across the course of a presidential campaign. Early in the primary season, when knowledge is imprecise, a little new information can go a long way — even as far as changing a voter's preferences. But late in the general election, in the weeks before the general election, voters will typically have precise priors about the positions of the candidates. So even a lot of new information, even precise new information, will not induce a change in voter preferences. Late in the campaign,

though, the major source of change should instead be in the precision of their beliefs; that is, in their certainty about the candidates.

3 Simple Tests of the Bayesian Learning Model: The 1976 Presidential Election

So do campaigns provide information to voters about the positions of the candidates? And do voters learn about these positions during the campaign? To answer these questions, I focus on the 1976 election.[12] Using data from Thomas Patterson's panel study and media content analysis from this election, I test the hypotheses derived from the Bayesian learning model. This section begins by discussing the information provided to the electorate in 1976, as reflected by mass media coverage of the candidates. It is clear from this discussion that, unlike the claims of many, the media during this election provided a great deal of coverage of the positions of both Ford and Carter, and that the dynamics of this coverage correspond to campaign events. Then I turn to the individual-level survey data and show that there are substantial reductions in voter uncertainty of the positions of the candidates during the campaign, which are directly related to the flow of information. These reductions in uncertainty, moreover, occurred for the *least educated, informed, and politically-exposed* respondents. I close with a discussion of these important results.

The measure of uncertainty I employ in this section is taken from Alvarez (1992). There have been two types of survey-based measures of uncertainty in the literature. First, there are the direct survey question approaches to measuring uncertainty (Aldrich et al. 1982; Alvarez 1992; Alvarez and Franklin 1993). In these attempts to probe voter uncertainty, survey questions are explicitly designed to probe uncertainty; some of these attempts have been quite successful (Alvarez and Franklin 1993). Second, there are indirect approaches. These rely upon the use of surrogate measures, which either serve as instruments for uncertainty (Bartels 1986; Franklin 1991), or as attempts to operationalize uncertainty from survey questions. My measurement strategy takes the latter approach.

In the Bayesian model, the voter's prior, newly-obtained, and posterior information were assumed to be distributed with a mean and a variance. My approach relies upon operationalizing this variance in voter understandings of the policy positions of candidates, by measuring:

$$v_{iJ} = \frac{1}{k}\sum_{k=1}^{K}(P_{kJk} - T_{Jk})^2 \tag{12}$$

where v_{iJ} represents voter i's uncertainty in their placement of J, P_{iJk} gives i's placement of J on each of the relevant k policy dimensions, and T_{Jk} indicates the position of candidate J on policy dimension k.

[12] I am currently undertaking an identical analysis of the 1980 election.

This is a representation of the voter's uncertainty about the candidate's position across the policy space, in terms of the net dispersion of the voter's perception of the candidate's position and the candidate's true position. The greater the dispersion of their perceptions of the candidate's position from the candidate's true position (here measured by the mean placement of the candidate on each issue across the particular sample), the more uncertain they are about the candidate's position on the policy issues; the tighter this dispersion of points, the less uncertain they are about the candidate's position.

This representation of voter uncertainty is appealing for three reasons. First, unlike the measures of uncertainty often employed in the literature, this representation directly operationalizes uncertainty from the survey data, and does not infer indirectly a uncertainty measure from ancillary information about respondents. Second, this measure meshes closely with the "precisions" as discussed in relation to the Bayesian model, which will allow for rigorous tests of the implications of that model. Third, this measure can be applied to existing survey data, particularily the historical data from the National Election Studies, where there are questions asking respondents to place candidates on policy scales.

But, before moving directly to the 1976 election, it is important to discuss what this particular measure does not do. One, unless repeated measures about the same policy issues were posed to the respondent, this measure cannot gauge uncertainty about specific issues. Instead it is intended to measure more generally the uncertainty the voter has about candidates across issues. Also, the accuracy of this measure will depend upon the accuracy of the questions used to measure both the voter's and the candidate's positions on the issue. However, without direct survey questions probing respondent uncertainty, this approach is quite attractive.[13]

3.1 Information Dynamics in the 1976 Campaign

For learning about the positions of the candidates to be possible, a baseline level of information is necessary. That even minimal levels of information about the positions of the candidates in 1976 was made available by the mass media is in dispute. Thomas Patterson, analyzing the same data I use in this section, concluded that "the press concentrates on the strategic game played by the candidates in their pursuit of the presidency, thereby de-emphasizing questions of national policy and leadership" (Patterson 1980: 21). As shown in Patterson's analysis, the media does appear to focus on the strategic aspects of the presidential contest relative to more substantive matters.

So in order to discuss the effect of the campaign on voter perceptions of candidate issue positions, I present evidence on the information dynamics of the 1976 presidential campaign. A precondition for voter learning to occur is that the electorate must be presented with information during the campaign. But to show that learning occurred regarding the uncertainty

[13]More discussion of this measure of uncertainty, and the others in the literature, can be found in Alvarez (1992) and Alvarez and Franklin (1993).

of the electorate about the positions of Ford and Carter in 1976, I need to demonstrate that information about their positions was in fact transmitted during this election, and that voter perceptions responded to this information. The Bayesian model developed above posited that when presented with new information, voter uncertainty should diminish. The central task here is to demonstrate that increasing amounts of substantive, issue-related information was presented to the electorate during the 1976 campaign, and that aggregate voter uncertainty fell accordingly.

Now I show first that coverage of the two major candidates was quite substantial — more information about the major candidates was made available to the electorate as the campaign progressed. But even more important, the relative proportions of substantive information (including information about the positions of the candidates) to strategic information changed quite dramatically across the campaign. During the general election period, moreover, substantive information actually exceeded strategic information. And last, the dynamics of information during the general election period are related to campaign events.

To simplify discussion of the 1976 campaign, I present in Table 1 a breakdown of the major events during the ten-month period from January to October 1976. This table gives the beginning and ending events of the primary season, which stretched from January until the end of June. The party conventions were held in mid-July (Democrats) and in mid-August (Republicans). After the conventions, the general election campaign got underway, and was structured around three debates. The first debate (September 23) was focused on domestic and economic issues, and Ford was eventually declared the "winner." With Ford's support increasing after the debate, Carter began to attack Ford more directly (Kessel 1984: 157). The second debate (October 6) was held in San Francisco and covered foreign policy. It was during this debate that Ford, responding to a question about relations with the Soviets, remarked, "There is no Soviet domination of Eastern Europe, and there never will be under a Ford Administration" (*New York Times*, October 7, 1976, 1:6). Ford eventually recanted, and in the aftermath, was forced to campaign personally and through paid advertising very heavily, while the Carter campaign engaged in an increasingly negative campaign against Ford. The race continued to tighten, and perhaps in response, during the third debate both candidates were very cautious. Then, with just over a week remaining, both candidates began the final phase of their campaigns with a flurry of advertisements and appearances. And on November 2 Carter barely won by sweeping the South and taking enough Northern states to give him a slim electoral college victory.

So, did the media coverage of the campaign correspond to these campaign events? To examine the information dynamics of the campaign I used Patterson's media content data. Patterson randomly selected over 6,500 politically related news stories concerning the 1976 election from nine mass media outlets, including newspapers, magazines, and television networks. These stories were analyzed in great detail, and from the content codes I extracted 8,834 "candidate mentions," in which Patterson coded a reference for a specific candidate relating to a specific topic.[14]

[14]Patterson's media content analysis actually is contained in two datasets. The first is the content analysis

Using these data, I first aggregated the reference topics during each month of the campaign following Patterson's guidelines: stories relating to evaluations of the candidate, strategies, tactics, logistics, support, campaign style, horse-race, appearances, and chances for victory were grouped under the label "hoopla", while stories about the issue stands, ideologies, records, traits, and endorsements, of the candidate were categorized as "substance."[15] The results of this analysis are presented in Figure 3.

Here the percentage of stories falling into either category is given on the y-axis, and the x-axis presents the month of the campaign. The dark line gives the percentage of substantive stories, while the light line gives the percentage of stories focused on the campaign.[16] Notice that there is a great deal of temporal fluctuation in the proportions of coverage relating to each topic. Not surprisingly, the primary election period, from January to June, is overwhelmingly devoted to the campaign and hoopla. That is, during the 1976 primary election season, the information transmitted to the electorate about the campaign by the mass media concerned primarily stories about the candidate's positions in the horse-race, their strategies and tactics, and other non-substantive information.

However, notice that during the general election period, this trend changes dramatically. In July and August, during both party's conventions, coverage of substance rises greatly. Thus, in 1976 it is apparent that during the late stages of the nomination process, and in the early stages of the general election, that the information dynamic of the campaign shifted heavily away from *primarily hoopla to roughly balanced coverage of substance and the campaign.* In September, coverage of substance actually was greater than that of the campaign, and in October the levels of hoopla versus substantive coverage were virtually identical.

Therefore, Figure 3 provides evidence of an important informational dynamic in the 1976 campaign. The coverage relating specifically to the candidates was largely devoted to the campaign throughout the primary election. But this began a dramatic shift during the transition between primary and general elections (during the conventions), until there were roughly even amounts of both types of candidate references in the general election. Thus, since the amount of substantive coverage concerning the candidates increased during the general election, one precondition for voter learning about the positions of the candidates exists.

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of all of more than 6,500 stories. The second is a sub-set of the first dataset, into which Patterson placed all candidate-specific media references. For each story, up to eight specific candidate "mentions" were coded and placed in the second dataset. My data were drawn from this second set. Each observation in this dataset is a story, with source and date information. Each candidate mention is indexed by candidate, the subject of the reference, and a number of evaluation codes. Here I employ only the date, candidate, and subject codes.

[15]See Patterson 1980: 186, note 5.

[16]In my analysis of the media coverage of the 1976-1988 campaigns as reflected in the *New York Times Index* that I found with a similar coding scheme that two-thirds of the general election media coverage focused on the campaigns, and only one-third on substance (Alvarez 1992). That result paralleled the findings of both Patterson (1980) and Graber (1983). It is interesting to note that while these three studies all converge on these aggregate percentages of substance versus hoopla, I show in the next set of figures an amazing amount of volatility in these relative percentages over the 1976 campaign.

Yet, was the coverage of the two major party candidates also evenly balanced? Or did one candidate receive more coverage during the campaign? Or did candidate coverage fluctuate over the election year? To probe into these questions, I present in Figure 4 the percentages of references each month to Ford (dark line) and Carter (light line). Again, the y-axis gives the percentage of stories for each candidate, while the x-axis gives the month of the election. Note, however, that the percentages are calculated here as the number of coded references to the particular candidate out of the total number of references to all candidates in that period.[17]

The trends in information during the election about the two major party nominees also parallel the events in the campaign quite well. In Figure 4 note that in the early days of the primary season, Ford received a great deal of coverage while Carter received little: in January, Ford received over one-third of all references to candidates in the sampled news media, while Carter was mentioned in less than ten percent of the time. While Ford's coverage remained relatively constant throughout the primary election period, the upward trend in Carter references is striking, and quite closely parallels his success in the Democratic primaries.

Then, Carter's references peak during July — the month of the Democratic convention. Ford's mentions, after being at a constant 20% or so, climb to almost half of all candidate references in August — the month of the *Republican convention.* In September and October, the general election period, both Carter and Ford received similar levels of references. However, Carter had slightly less coverage in the last two months of the election year, which gives another indication of the difficulties of challenging even a non-elected incumbent president.[18]

Next, I examined the trends in hoopla and substantive references to both Ford and Carter. These are presented in Figures 5 and 6. Figure 5 gives the percent of hoopla references in each month for both candates on the y-axis, and the month of the campaign on the x-axis. Figure 6 is identical, except that the percentages of substantive stories for the two candidates are graphed. In each figure, the dark line gives the percentages for Ford over the election year, and the light line for Carter.

Starting with Figure 5, notice first that the trends in hoopla coverage for each candidate roughly parallel those for total candidate coverage just discussed. Carter received very few campaign-related references early in the primary season, but the percentage of mentions concerning Carter's campaigning steadily climbed to peak at 35.8% in July, the month of the Democratic convention. Campaign references for Carter dropped sharply during August, the month of the Republican convention, but jumped quickly back upward during the last two months of the election. Ford received a great deal of hoopla references in the first month of the election, with almost 37% of the references in January. Again, this dropped to just over 20%, where his campaign-related references hovered until August. During the month of his party's convention, the campaign-related mentions for Ford jumped to almost 50% of all

[17]That is why the percentages, especially in the primary season, do not sum to one hundred.

[18]In September and October Carter received 45.9 and 44.9% of the references, respectively, while Ford picked up 48.4% in September and 51.1% in November.

such references. During September and October, Ford's hoopla references in the mass media were very similar to Carter's.

But a different dynamic is clear in Figure 6. Here, Carter begins the election with almost no substantive coverage (only 6%). This is not surprising, given that he was competing for substantive coverage with so many other, and so many better-known, primary candidates in both parties. But with early successes, Carter's substantive coverage climbed to almost 30% of all references in March through May. During June and July, though, the percentage of substantive mentions of Carter skyrocketed: 50.8% in June (the last months of the Democratic primary) and 62.9% in July. The substantive references to Carter did drop during August, and leveled off at just over 40% during the general election months of September and October.

Ford, on the other hand, began with the lion's share of substantive coverage in January (30%). He received approximately one-fifth of substantive coverage from February until July, during the entire primary and early convention season. But during August, and the Republican convention, substantive coverage of Ford jumped considerably, to 48%. And Ford received over half of the substantive mentions in September and October, at least 10% more than Carter obtained.

Thus, I have established that quite dramatic changes occurred in the media coverage of the 1976 election, especially as it pertained to references to Carter and Ford. And it is clear that the informational dynamics in Figures 3-6 concide closely with the major events of the campaign. This evidence alone shows that in 1976 the preconditions for substantial voter learning about the positions of both Carter and Ford existed. That is, during the campaign, considerable information about the candidates was available in the mass media, and the coverage of both major candidates, especially their substantive coverage, did increase dramatically in the post-primary period of the election year.

Yet substantive coverage is not entirely made up of references to the issue positions of the two candidates. To more precisely understand the dynamics of issue coverage, I graphed only those references to Carter and Ford dealing with their positions on domestic or foreign policy issues.[19] These are given in Figure 7, where the y-axis now gives the percentage of issue-specific mentions for Ford (dark line) and Carter (light line) during each month of the campaign.

[19]Patterson coded as issue references those mentions which concerned the economy, unemployment, government employment, inflation, tax reforms, abortion, working with Congress, crime, social welfare, government spending, government efficiency, social security and medicare, minority rights, women's rights, federalism, health care, the environment, consumer protection, gun control, education, drugs, energy, cities, busing, as domestic issues; military spending, foreign involvement, detente, foreign aid, the Middle Ease, OPEC, U.S. world prestige, general foreign policy, Panama Canal, nuclear weapons, and other miscellaneous foreign and defense topics, as foreign issues. There were a total of 482 domestic issue references (152 for Carter, 219 for Ford, 111 for other candidates) and 1003 foreign issue references (385 for Carter, 350 for Ford, and 268 for the other candidates).

The trends in Figure 7 are even more interesting than those shown for the broader category of substantive references. Here, Carter once again begins with exceptionally low levels of issue references (less than 10% in January), which is quite understandable given that he was the unknown outsider candidate in the early Democratic primaries. Befitting his success in the early primaries, though, Carter does pick up a reasonable level of references to his issue stands from February to May.

But in June, and then in July, mentions of Carter's positions on issues shot to 52% (June) and 76.2% (July), as the campaign progressed from the late primary stage to the Democratic convention. In particular, that Carter's issue positions received almost eight out of ten references to all candidates in July is amazing. However, the tremendous coverage of Carter's positions dropped to 40% in August, climbing to just over 50% by October.

Ford received a constant 30% of the issue-specific coverage during most of the primary period, from January to May. As the attention shifted to Carter's positions, when it became unavoidable that Carter would be the Democratic nominee, references to Ford's positions fell to approximately 20% of all candidate issue mentions in June and July. Yet with the advent of the Republican convention in August, Ford's positions received a great deal of coverage by the mass media. And again, the coverage devoted to Ford's issue stands during the general election was almost identical to that given to Carter.

These figures demonstrate three points about the 1976 election. The first point is that there was a substantial amount of information available about the two major party candidates in this election. The entire sample from which these percentages were calculated had over 8,000 candidate-specific references, and were drawn from a random sample of 6,500 political news stories. Thus, a great deal of information was available about the candidates in 1976.

Secondly, the flow of information during this campaign had clear and very understandable dynamics. Each of the five figures demonstrated that the information available about the two party candidates varied over the election year. Hoopla coverage dominated substantive coverage — but only in the primary campaign. Substantive coverage rose dramatically during the period of the party conventions, and actually was greater than campaign coverage during the two general election months (Figure 3). Total references to Carter were few in the early primary months, but rose greatly in June and July of the election year; references to Ford were relatively constant through the entire campaign period, only rising after July (Figure 4). Hoopla and substantive coverage specifically devoted to Carter and Ford followed similar dynamics (Figures 5 and 6).

And thirdly, both the broader substantive references and the narrow, issue-specific, references to these two candidates show dramatic increases during the convention and general election periods (Figures 6 and 7). Therefore, information about the positions of both Ford and Carter, while relatively sparse before June of the election year, became relatively abundent thereafter. This implies that the informational environment in 1976 could have been conducive to voter learning about the policy positions of both Ford and Carter, since clearly a great deal of information appears to have been transmitted via the mass media during

the later stages of this presidential campaign. Note last that the trends in information are especially strong for Carter, who as the outsider begin with a considerable deficit in media coverage of his campaign. That substantive, and especially issue-specific, coverage of Carter skyrocketed in the early stages of the general election campaign, provided an excellent window for voters to learn about his policy positions, and perhaps explaining why he ended up as well known as the (unelected) incumbent.

3.2 Voter Learning in 1976

Yet it remains to show that voters did learn from this information flow in 1976. To demonstrate that voter learning did occur, I return to the Bayesian learning model. It is possible to test the hypotheses were deduced from the theoretical analysis by exploiting the panel data which was also collected by Patterson in 1976. The first hypothesis from the Bayesian model stated that with increasing information, voter uncertainty should change. I have shown in the previous section that increasing information about the candidates, *and about their policy positions* was made available as the campaign progressed. To substantiate this first hypothesis, I show that voter uncertainty of the positions of the candidates reduced accordingly.[20] The uncertainty measures for the two candidates (discussed above) across the five panel waves are the basis for the rest of the analysis in this section.

A simple test is to examine the aggregate levels of uncertainty across the five panel waves. Thus, I calculated the uncertainty means for each candidate in each survey wave. These means are given graphically in Figure 8. There, the mean uncertainty level in a particular survey wave are given by the y-axis, and the consecutive survey waves are given along the x-axis.[21] The filled bar indicates the mean uncertainty level for Ford, and the unfilled bar the mean uncertainty for Carter, in the particular survey wave.

Figure 8 affirms that aggregate uncertainty levels did drop substantially between February and October. The mean level of voter uncertainty about Ford's positions dropped from 5.69 in February to 4.40 in October, a change of 1.3 points. Most of this drop occurred between the second and third waves of the panel survey: between the April and June interview periods. Mean uncertainty about Carter's positions dropped virtually the same amount, as shown in

[20] In the 1976 panel data, nine seven-point scales ae available in the fifth and last wave of the survey. These covered government provision of employment, involvement in the internal affairs of other nations, wage and price controls, defense spending, social welfare spending, tax cuts, legalized abortion, crime, and busing. For the fifth wave, then, the uncertainty variables is constructed by subtracting the respondent's placement of the candidate on the issue from the candidate's positin, where the latter was measured by the mean position across all respondents placing the candidate on the issue. Respondents not placing the candidate were assumed to be maximally uncertain about the candidate's position. Unfortunately, three issue scales used to calculate the fifth wave uncertainty measures were not available in the first two survey waves and are not included in the calculation of the uncertainty measure for these two waves (foreign involvement, crime, and wage and price control scales.) I must point out that Patterson carried out extensive tests to determine if any changes in respondent reported perceptions were induced by the repeated surveying of their opinions; Patterson found no such artifacts in this data.

[21] The five survey waves were February, April, June, August, and October.

the figure. Most of the reduction in Carter policy uncertainty, though, occurred between August (fourth wave) and October (fifth wave), just after the massive flow of substantive and issue-specific information about Jimmy Carter. Interestingly, however, these reductions in Carter uncertainty are probably heavily understated. While most respondents in the first wave of the panel study recognized Ford and were able to place him on most of the policy scales, only 20% of these same respondents recognized Carter or were able to place him on the seven-point policy scales.[22] And those who could recognize Carter and place him on the scales in February were better educated, more informed about politics, and more exposed to political information — and hence they were probably much more certain of Carter's positions on the issues. This no doubt explains the "increase" in Carter mean uncertainty which is seen between the first two survey waves.

Thus, these observed reductions in voter uncertainty about the policy positions of both candidates in 1976 across the campaign, are evidence that voter learning occurred during the campaign. This supports the hypothesis taken from the Bayesian learning model, that as more information about the positions of the candidates is made available to the electorate, that reductions in uncertainty should occur.

But what of the patterns at the individual-level? Of course, it is possible that these the reductions in voter uncertainty at the aggregate level are masking more dramatic changes in the uncertainty voters had of the two candidates in the 1976 election. So I now turn to an analysis of the changes in the individual-level survey data.

My measure of individual-level changes in uncertainty about the presidential candidates is simply the difference between the voter's uncertainty about the policy stands of each candidate at two different points in time. I examined the changes in uncertainty between the second and third (April and June), and the fourth and fifth (August and October) survey waves. These two different time periods were chosen deliberately since the change in voter uncertainty between April and June occurred late in the primary season, while the change between the August and October waves fell during the general election contest. Examining the changes in uncertainty between the primary and general election contexts should provide insight into the possible effects each of these electoral institutions on voter awareness of the policy positions of the candidates.

However, rather than study the simple differences between each voter's uncertainty for the candidates at two points in time, I analyzed only the reductions in voter uncertainty which were substantial. To determine substantial changes in voter uncertainty, I calculated the two uncertainty differences and their standard errors. Changes between the two uncertainty measures at the individual-level were deemed substantial if they were greater or less than one standard deviation from zero. That is, positive changes greater than one standard deviation from zero were termed substantial *increases* in uncertainty, while negative changes

[22]There were 898 respondents for whom it was possible to calculate the uncertainty measure for Ford in the February panel. But only 184 respondents are included in the identical calculation for Carter in the first panel wave.

greater than one standard deviation from zero were called substantial *reductions* in voter uncertainty.

In Table 2 are given the percentages between the April and June, and the August and October, uncertainty measures. The first observation to make about the percentages in Table 2 is that most changes in uncertainty were within a standard deviation of zero. Since the standard deviations of the differences in candidate uncertainty presented here all were approximately 3, that means that most of the observed changes in voter uncertainty between these survey waves were plus or minus 3 points from zero. This is clearly a conservative measure of changes in uncertainty.

Secondly, note that in the primary period, approximately 20% of respondents had substantial *reductions* in their uncertainty of both candidates. The percentages with substantial reductions in their uncertainty increased by one percent for Carter, but fell by almost 7% for Ford. Thus, around one-fifth of the respondents according to this measure of changes in uncertainty became *more certain of the positions of the candidates in either survey period.*

Third, note that the percentages of respondents who were deemed to have had substantial *increases* in their uncertainty of the candidates during this election were generally small. The percent of respondents who appear to have become more uncertain of the positions of Ford and Carter is never much over 7% of the sample.

Again, the results reported in Table 2 provide support for the hypothesis that learning occured during the 1976 campaign. Approximately one-fifth of the respondents in either the primary period or the general election period became substantially more certain of the positions of Ford and Carter. Given that my approach to categorizing respondents as becoming more certain of the positions of the candidates is quite conservative, this is an important finding.

Yet the question remains — which respondents appear to have learned about the positions of the candidates in either the primary or general election period? Do voters with high information costs, or low exposure to political information, learn about the campaign? Or is learning confined to only voters with greater access to information, and lower costs of processing that information?

To answer these questions, I examined the mean education, political information, and media exposure, levels for those respondents who had a substantial reduction in uncertainty in the primary and general election periods relative to the means of the same three variables for those who had no substantial changes in uncertainty.[23] To ascertain the magnitude

[23]These three independent variables were operationalized from the 1976 survey data. Education was coded 1 for those with a grade-school education or less, 2 for those with a high school education, 3 for those with some college or vocational training, and 4 for those with college degrees. Political information is a ten-point scale where the respondent was given a point for each time both parties were placed on an issue scale and the Democratic party was placed as a more liberal party than the Republicans. Media exposure was constructed as a factor scale from variables measuring the regularity with which the respondent was exposed to news coverage in newspapers, news magazines, television news, and conversations with others. The principal

of the differences, I calculated the differences between each set of means and a p=0.05 confidence interval that the observed difference between the means implies a significant difference between population means.[24]

The results of this analysis are given in Tables 3 (differences in education), 4 (differences in political information), and 5 (differences in media exposure). Each table gives the mean level of the particular variable for the respondents who became substantially less uncertain about the candidate across the survey periods, the mean level for those with no substantial change in uncertainty, the difference in the two means, and the last two columns give the lower and upper bounds for the 95% confidence interval. The tables are arranged so that a positive difference between the means would indicate that those with substantial reductions in candidate policy position uncertainty would be better educated, politically informed, and media exposed than those with no substantial change in uncertainty; additionally, a negative difference indicates that those respondents with substantial reductions in uncertainty are less educated, informed, and exposed to the mass media.

Notice first that in each table, *the differences between the means are always negative.* Thus, respondents in the 1976 survey who became less uncertain of the positions of the candidates between the April and June survey waves, or the August and October waves, were less educated, less politically informed, and less exposed to the media than those who had no substantial change in their uncertainty. Secondly, most of these differences in means are statistically significant, meaning that for the differences in means that are starred, the null hypothesis that there is no difference in the population between the mean values of these three variables can be rejected with confidence. The only exception to this second observation are the differences in means for changes in Carter uncertainty between the April and June survey waves, and the differences in mean media exposure levels for Ford uncertainty reductions in the primary period.

These results are very interesting. As demonstrated elsewhere (Alvarez 1992), respondents who are better educated, informed, and exposed to the mass media coverage of the campaign are more certain of the candidates' positions at the end of the general election. The implication of these results is that in general these same voters do not become more certain of the positions of the candidates during the campaign, either in the primary or general election period. Thus, the voters who do reduce their uncertainty of the positions of the candidates, those voters who learn from the campaign, are less educated, informed, and exposed to the media coverage of the campaign.

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components factor analysis of these items yielded on factor, eigenvalue 8.37. For additional discussions of these variables and the Patterson data, see Alvarez (1992).

[24]The simple t-test for differences between means was implemented in SAS, using the GLM procedure. This test is subject to Type I error, in which one falsely rejects a null hypothesis, since the probability of incorrectly rejecting a null of no difference in population means increases as the number of t-test increases.

4 Conclusion

In the last section I provided evidence that during the 1976 campaign voters did learn about the policy positions of both candidates. First, I argued that even during this campaign the preconditions existed for voter learning to occur, since as the campaign progressed, the information flow increasingly concentrated on Carter and Ford, and on the substantive aspects of their candidacies — including their policy positions. Then, I showed with both aggregate and individual-level evidence that reductions in voter uncertainty occurred across the campaign, which I asserted to be confirmation of the prediction from the Bayesian learning model. Lastly, I demonstrated that these reductions in voter uncertainty did not occur randomly across voters, but rather were concentrated among the less educated, informed, and exposed to the mass media. These results confirm the prediction of the Bayesian learning model. New information made available by the campaign is incorporated into voter perceptions of the candidates, especially in their uncertainty of candidate policy positions.

This implies that presidential campaigns are important sources of information for voters. Additionally, campaigns provide information for those voters who start out less informed about the positions of the candidates, and gives these voters the vehicle with which to become more certain of where the candidates stand on the issues. And by becoming more certain of the positions of the candidates, these same voters become better able by the end of the general election to make their decision on the basis of policy issues.

Unfortunately, demonstrating that substantial changes in voter uncertainty lead to changes in preferences is not possible with the 1976 survey data. The learning model predicted that voters became dramatically more certain of a candidate's policy positions would also become more likely to prefer that candidate. There simply are too few respondents in the survey sample who had substantial reductions in their uncertainty, and who changed their candidate preferences in the general election, to test this hypothesis. Yet given that the voters who appear to learn the most during the campaign are also the most likely to have malleable preferences, it is quite likely that their preferences do change in response to the information they obtain from the campaign (Converse 1964; Zaller 1989).

Yet this analysis does show that voters do learn from presidential election campaigns. The lesson of the Bayesian learning model, and of the empirical work in this paper, is that we must keep in mind that there are many different types of information made available during a campaign, and that voters might incorporate this information into their prior beliefs in different ways. The manifestations of learning, then, can be found not only in changes in voter preferences, but in changes in their perceptions or misperceptions of the candidates as well.

Table 1: Campaign Events, 1976

Iowa Caucuses	*January 19*
New Hampshire Primary	*February 25*
Arkansas Primary (last)	*June 26*
Democratic Convention	*July 12–17*
Republican Convention	*August 17–20*
Domestic Policy Debate	*September 23*
Foreign Policy Debate	*October 6*
Third Debate	*October 22*
Election Day	*November 2*

Table 2: Changes in Voter Uncertainty, 1976

Candidate Periods	Change in Voter Uncertainty: Substantial Reduction	No Change	Substantial Increase
Carter			
April-June	22.4	70.0	7.6
Aug.-Oct.	23.4	72.8	3.8
Ford			
April-June	22.0	71.2	6.8
Aug.-Oct.	15.7	77.1	7.2

Entries in the three right columns are the percentages of respondents for whom the difference in their uncertainty for the each candidate was more than a standard deviation less than zero (substantial reduction), within a standard deviation of zero (no change), or a standard deviation greater than zero (substantial increase).

Table 3: Education and Changes in Voter Uncertainty, 1976

Candidate Periods	Education Mean Substantial Reduction	Education Mean No Change	Difference In Means	Lower Bound	Upper Bound
			Education Differences in Sample:		
Carter					
April-June	5.06	5.13	-0.07	-0.42	0.28
Aug.-Oct.	4.74	5.14	-0.41*	-0.74	-0.08
Ford					
April-June	4.56	5.10	-0.54*	-0.86	-0.22
Aug.-Oct.	4.33	5.08	-0.75*	-1.11	-0.39

Entries give the education means and differences in these means, for respondents who substantially reduced their uncertainty of the particular candidate versus those who had no substantial change across the two survey waves. The two right columns give the 95% confidence interval bounds. * denotes that the difference in means is statistically significant at the p=0.05 level.

Table 4: Political Information and Changes in Voter Uncertainty, 1976

Candidate Periods	Information Mean Substantial Reduction	Information Mean No Change	Difference In Means	Lower Bound	Upper Bound
		Information Differences in Sample:			
Carter					
April-June	5.33	5.60	-0.27	-1.11	0.56
Aug.-Oct.	5.00	6.72	-1.72*	-2.42	-1.02
Ford					
April-June	4.39	5.18	-0.79*	-1.53	-0.04
Aug.-Oct.	4.25	6.37	-2.11*	-2.88	-1.34

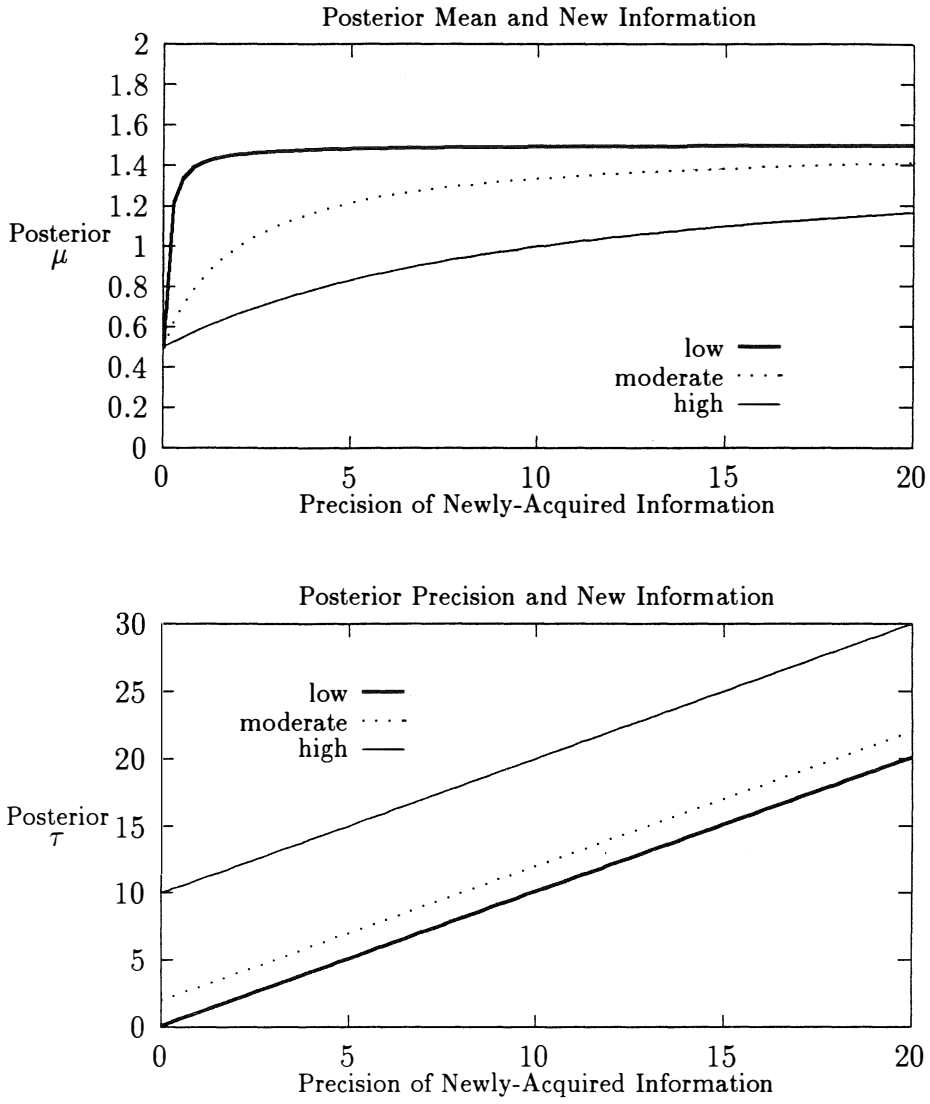
Entries give the political information means and differences in these means, for respondents who substantially reduced their uncertainty of the particular candidate versus those who had no substantial change across the two survey waves. The two right columns give the 95% confidence interval bounds. * denotes that the difference in means is statistically significant at the p=0.05 level.

Table 5: Media Exposure and Changes in Voter Uncertainty, 1976

Candidate Periods	Media Exposure Differences in Sample: Exposure Mean Substantial Reduction	Exposure Mean No Change	Difference In Means	Lower Bound	Upper Bound
Carter					
April-June	8.90	9.04	-0.14	-0.85	0.55
Aug.-Oct.	9.34	10.1	-0.71*	-1.18	-0.25
Ford					
April-June	8.75	8.75	-0.00	-0.63	0.62
Aug.-Oct.	9.02	9.90	-0.87*	-1.39	-0.39

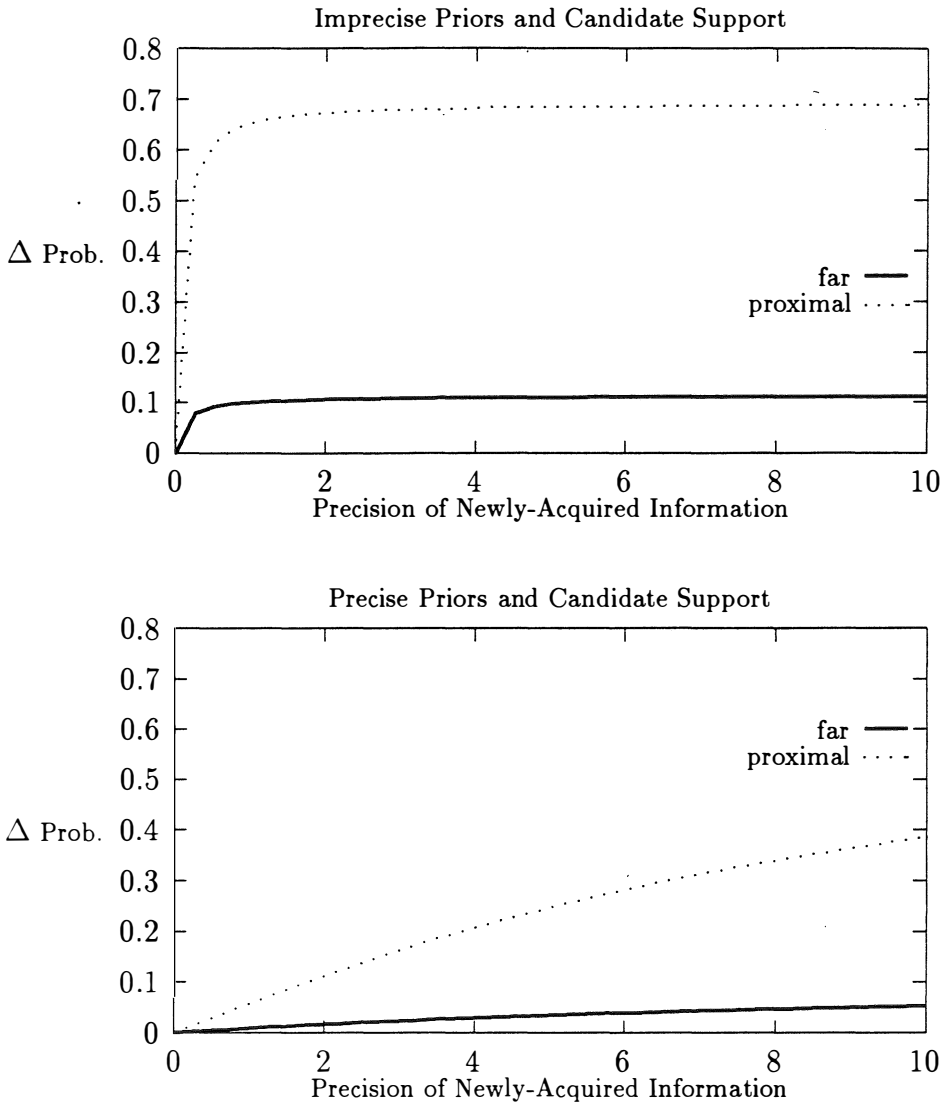
Entries give the political exposure means and differences in these means, for respondents who substantially reduced their uncertainty of the particular candidate versus those who had no substantial change across the two survey waves. The two right columns give the 95% confidence interval bounds. * denotes that the difference in means is statistically significant at the p=0.05 level.

Figure 1: Voter Learning: New Information About a Candidate's Position



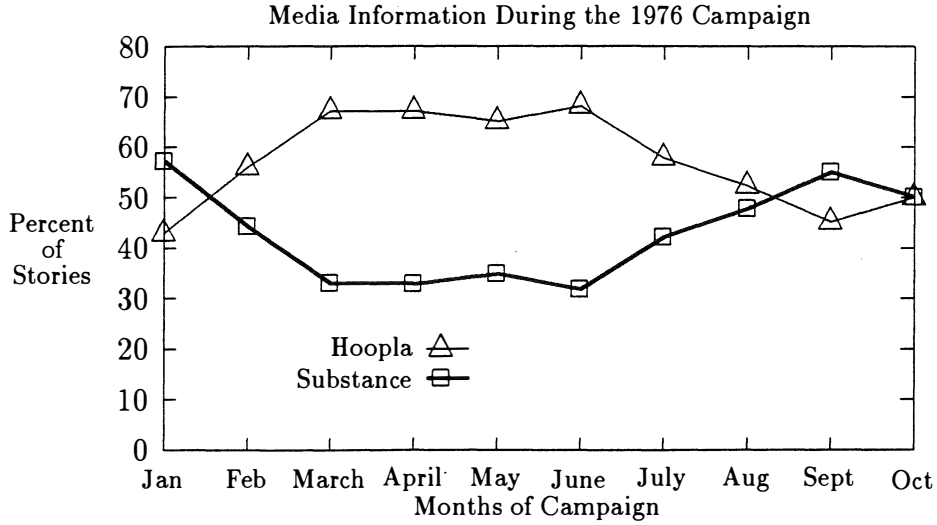
Note: Each panel shows the effect of new information about the candidate's position, across the range of precisions of the new information (given on the x-axis). The three levels of a voter's prior precisions of a candidate's position (low, moderate, high), are given by each line. The top panel gives the effects of the new information on the voter's posterior mean, the bottom on the posterior precision.

Figure 2: New Information and Changes in Voter Preferences



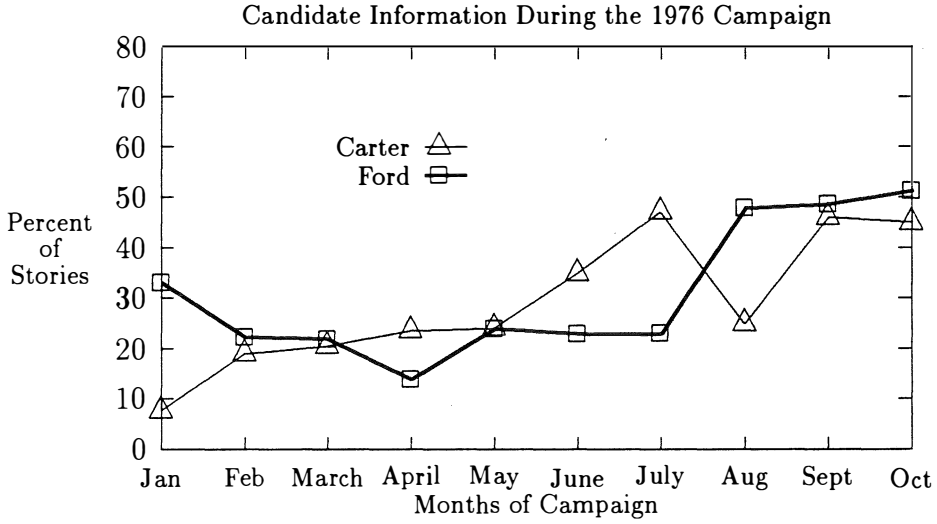
Note: Each panel shows the effect of new information about the candidate's position, across the range of precisions of the new information (given on the x-axis). The dark line in each panel depicts new information which indicates that the candidate not much closer to the voter; the dotted line information that the candidate is much closer to the voter. The top panel shows a simulation where the voter's prior was imprecise, and the bottom panel where the voter's prior was precise.

Figure 3: Hoopla and Substance, 1976



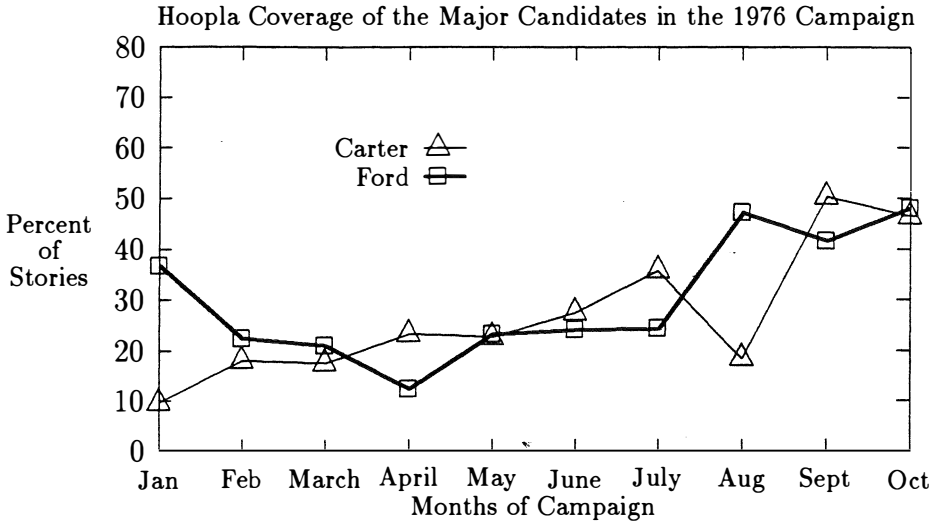
Note: Data from 1976 Patterson media content analysis. Percentages are of all candidate-specific mentions.

Figure 4: References to Carter and Ford



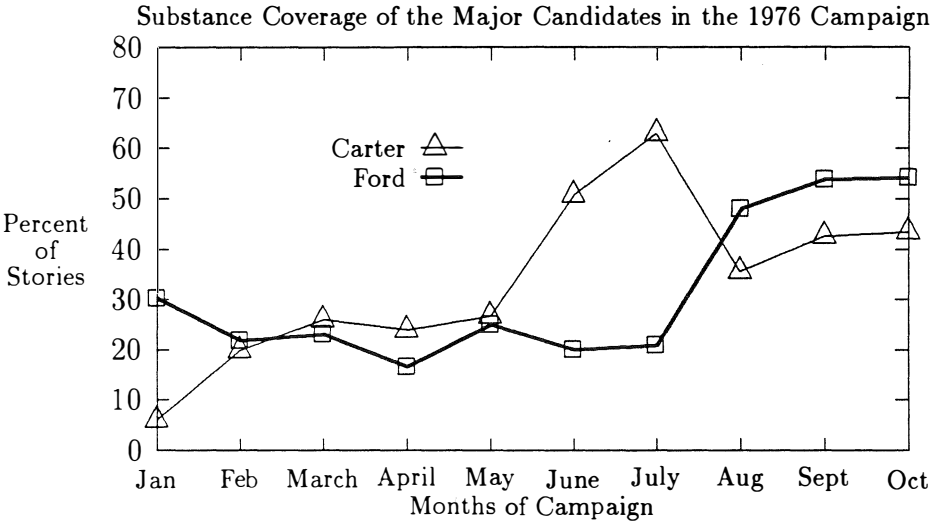
Note: Data from 1976 Patterson media content analysis. Percentages are of all candidate-specific mentions.

Figure 5: Hoopla Coverage, 1976



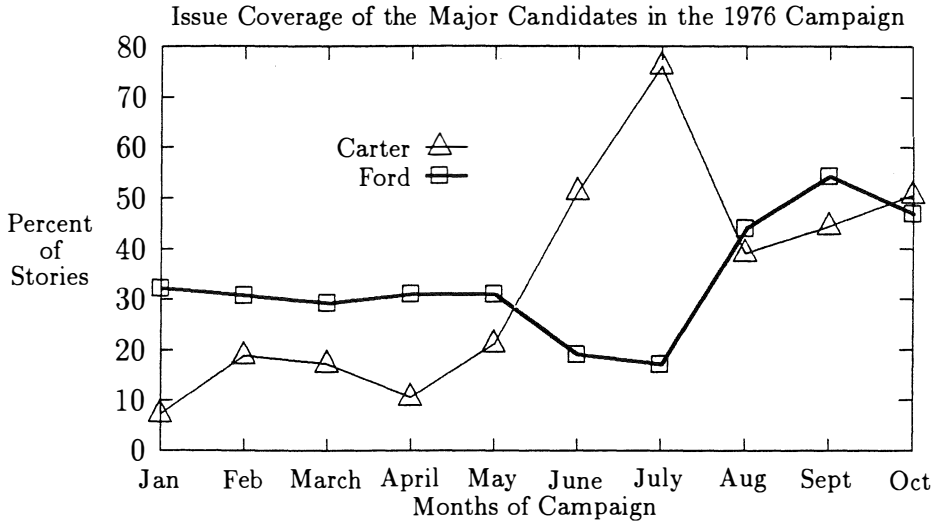
Note: Data from Patterson 1976 media content analysis. Percentages are of all candidate-specific mentions.

Figure 6: Substance Coverage, 1976



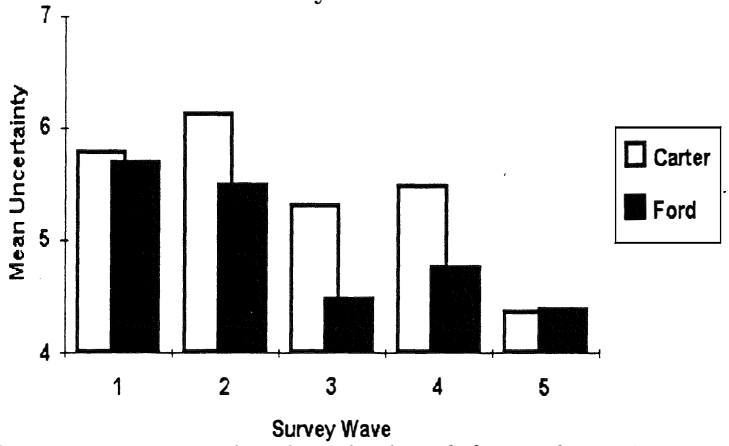
Note: Data from Patterson 1976 media content analysis. Percentages are of all candidate-specific mentions.

Figure 7: Issue Coverage, 1976



Note: Data from 1976 Patterson media content analysis. Percentages are of all candidate-specific mentions.

Figure 8: Mean Uncertainty Levels Across the 1976 Elections



Note: Mean uncertainty levels calculated from the 1976 panel study. The survey waves on the x-axis are bi-monthly from February to October, 1976

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